Journal of Chemical and Pharmaceutical Sciences ISSN: 0974-2115

# Development of Communication Device for Blind-Deaf People: Mobile Lorm Glove

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**ABSTRACT**

Deaf-blindness is a disability where an individual has little or no useful sight and little or no useful hearing. This impairment requires the person to depend on a caretaker for conventional communication. This paper proposes an efficient way of communicationby a method called Improved Mobile Lorm Glove. The hand-touch alphabet Lorm, a common form of communication used by people with bothhearing and sight impairment translatesthe sensation into text and vice versa by the glove. The input section consists of numerous capacitive touch sensors which correlate with the different characters of Lorm alphabet. Whenever each Lorm alphabet sensor is activated, corresponding alphabet is sent to the receiver's handheld device through GSM. The output unit consists of small vibrating motors which translates the incoming text messages into Lorm patterns. Thus, deaf-blind people communicate their ideas with the help of Lorm glove. This paper also discusses previous related work, prototype design and interaction. This paper also gives an over view of the research work that can be done in future.

**KEYWORDS:**Deaf-blind, Lorm, Sensors, Vibration motors, Disability, Glove, Interaction, Mobile Communication, Tactile Alphabet.

## INTRODUCTION

Communication is the powerful tool for every individual to share their ideas. Unfortunately, millions of deaf-blind people are excluded from several forms of communication. Deaf-blind people suffer from dual sensory-impairment with a combined loss of hearing and sight. Hence, it is difficult for deaf-blind people to connect with the outside world because of the lack of a common language. With the proposed work, a permanent communication becomes possible. The most common language used for usual communication by the Deaf-Blind people is "Lorm". In Lorm some characters are formed by a stroke from one mark to another. The major advantage of Lorm is that it uses continuous movements to represent an alphabet. Lorm patterns on the left hand is shown in Figure 1.The "speaker" touches the palm of the "reader's" hand to sequently draw the characters onto it by tracing lines and shapes. Some characters are formed by a stroke from one mark to another.

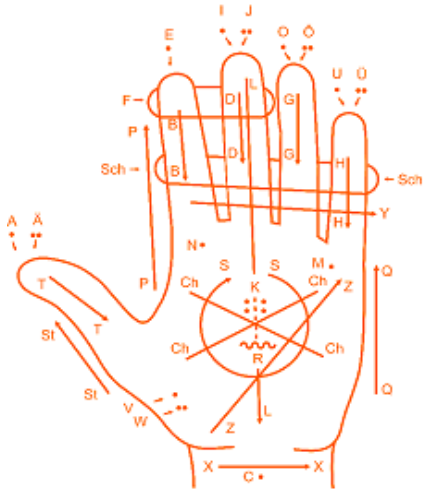


**Figure.1.Lorm manual alphabet**

The major advantage of Lorm is that it uses continuous movements to represent an alphabet. This concept is incorporated in the glove design.

**Proposed protype design:** This paper proposes a mobile communication and translation device for deaf-blind people.A deaf-blind person's quality of life depends on communication that is clear, concise and accessible. They may face great difficulty in knowing for certain what is happening around them or in communicating with those they meet. Thus the paper enables the deaf-blind to be independent. The glove has capacitive pressure sensors

Journal of Chemical and Pharmaceutical Sciences ISSN: 0974-2115

which are located on the palm of the glove and vibration motors on the back. Position of sensors and motors is based on Lormpattern. With the help of sensor, deaf-blind user composes text messages in Lorm language. The deaf-blind user wears the Mobile Lorm Glove on the left hand and uses the tips of the fingers of the right hand to Lorm onto his or her own left hand to compose text messages. The left hand is to be open with its fingers slightly spread. Embedded 'C' coding is developed in microcontroller for sending and receiving messages. For each sensor being touched, microcontroller generates the corresponding code depending on the program. The data is transmitted from glove to the user's handheld deviceby meansof GSM and it is passed to the receiver's handheld device by SMS.

If the wearer of the Mobile Lorm Glove receives a text message, the message will be forwarded via GSM from his/her handheld device to the glove. Coin sized vibration motors located on the back of the glove allows the wearer to understand the incoming messages through vibrations. Bidirectional communication through sending and receiving messages enhances them to share their ideas. Mobile Lorm glove helps in parallel one-to-many communication for deaf-blind. As a result, it empowers deaf-blindpeople to engage with a broader spectrum of people, thus enhancing their independence.The fundamental objective of this paper is to design a portable embedded system and thereby to develop an economical and simple solution for the detection of finger movements through sign language and to device a reliable data acquiring method and signal conditioning.

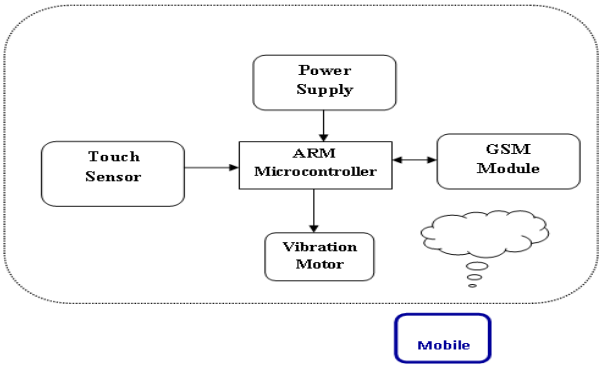


**Figure.2.Block diagram of the Mobile Lorm Glove**

The hardware requirements for this project includesCapacitive touch sensors that serves as the input module, ARM microcontroller that obtains the input from the sensor and stores it, GSM module that allows the instantaneous transmission of text message stored in the microcontroller and vibrating motors serve as the output module through which the message is received by the Blind-Deaf person.The hardware used in this device is chosen with the factor of compactness and fluidity. Sensors are used as the major component and the transmission is done via ARM microcontroller and GSM.

The output module involves shaft less cylindrical motors. The Processor used here is ARM LPC2378 whose Clock Speed is 12 MHz, RAM capacity 60 Kilo bytes,ROM 512 Kilo bytes. The sensors used here are capacitive type touch sensors. Motors used are coin sized vibration motors and GSM Module enables wireless transmission of data. The input unit consists of a matrix of 35 fabric pressure sensors similarly as described in. 34 of the round shaped pressure sensors, which are 10mm in diameter, correlate with the different characters of the Lorm alphabet. The rectangular sensor located on the wrist of the glove is needed to signal the completion of an entered character. Figure 3. Positioning of the sensors (l), positioning of the vibrating motors (r). This sensor does not only differ in its shape and size, but also in its texture to clearly distinguish it from the other pressure sensors.

The capacitive sensors changes its electrical resistance undermechanical pressure. The predetermined pressure points can easily be traced along an embroidered tactile guidance system depicting the patterns of the Lorm alphabet.The output unit is defined by a matrix of 32 shaftless coinvibrating motors each with a diameter of 8mm, an operatingfrequency rangeof 200Hz and an operating voltage rangeof 3.3V designed for haptic(sense of touch) vibrating feedback functions inhandheld applications. Their location is again based on thepatterns of the Lorm alphabet (see Figure 2). They serve asdirect feedback for the input sensors and translate incomingtext messages into Lorm patterns.

Traditionally, the deaf-blind shows the palm of a hand to the "speaker", who uses the tips of his or her fingers to Lorm onto it. The deaf-blind user wears the Mobile Lorm Glove on the left hand and uses the tips of the fingers of the right hand to Lorm onto his or her own left hand to compose textmessages. The left hand is open with its

Journal of Chemical and Pharmaceutical Sciences ISSN: 0974-2115

fingers considerablyspread.The sampling of input data uses event triggered interruptsinitialized by the pressure sensors. The received data is thencompared with the entries in a look-up table. Each characteris then serial-processed to the handheld of the user via a GSM module connection.

**Figure.3.The hardware prototype of the glove**

In traditional Lorm, individual characters are signalled by touching different touch marks. Some characters require single touch, some a second touch that follows at the same spot after the first one. In our participatory design sessions we discovered a significant difference regarding deaf-blind people's speed of lorming. Due to this individual speed it is not possible to use a time interval to distinguish between two different characters using the same touch mark. If the wearer of the Mobile Lorm Glove receives a text message, then it is forwarded to the glove from his or her handheld device through Bluetooth. Then it is translated into the Lorm alphabet. The incoming message is perceived by the user (loam glive wearer)by means of small vibrating motors. This process is carried out with help of control unit for each character and converted into a sequence. The motors are controlled by PWM signal.Sequence of program required to transmit and receive messages on the glove is explained. Figure .4.shows the flow chart of the working of the mobile communication device for deaf-blind people to send text messages.

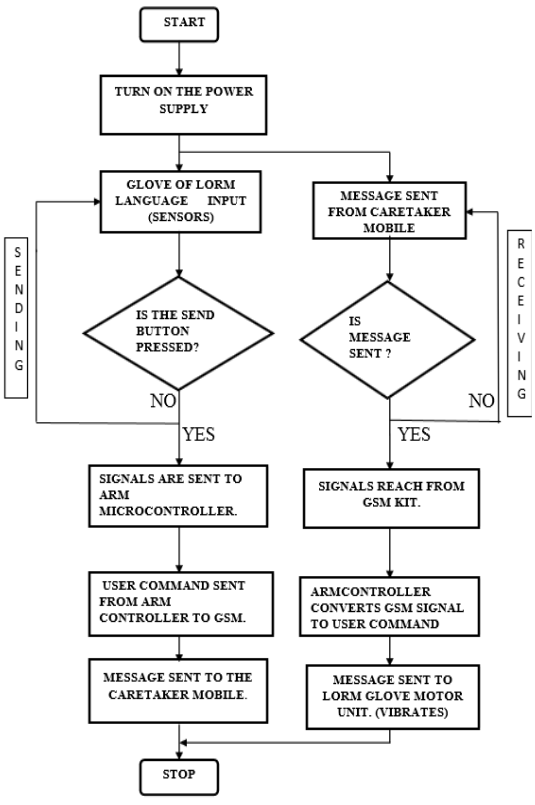


**Figure.4.Flow chart of mobile Lorm glove**

Journal of Chemical and Pharmaceutical Sciences ISSN: 0974-2115

## RESULTS AND DISCUSSION

Based on Lorm language, 26 touch sensors are connected in sending section. Each sensor corresponds to an alphabet. Figure. 4 shows the positioning of sensors in the palm based on the Lorm language.

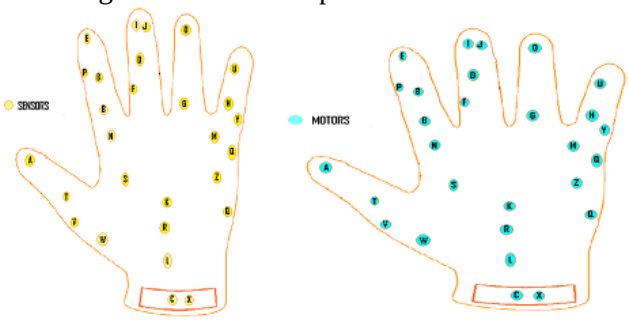


**Figure.5.Positioning of sensors and motors (left hand-palm) based on Lorm language**

According to the text to be transmitted, in this case, "HELLO", the corresponding sensor is touched. For each sensor being touched, microcontroller generates the corresponding code depending on the program. This generated output is transmitted to the GSM module which transmits the SMS to a hand-held device and the SMS is received as vibrations.The table 1.1 shows the sensors and motors activated to send and receive the text "HELLO".

**Table.1.Table showing the sensors and motors activated to send and receive the text"HELLO".**

| POSITION | GESTURES | LETTER |
|---|---|---|
| Strike downwards along the little finger from the tip till just above the palm. | Send – Touch<br>Receive- Vibrate | H |
| Tip of the index finger | Send – Touch<br>Receive- Vibrate | E |
| Strike downwards with 3 tips along the index, middle, ring finger from the tip palm **(Repeat Twice)** | Send – Touch<br>Receive- Vibrate | L |
| Tip of the ring finger. | Send – Touch<br>Receive- Vibrate | O |

## CONCLUSION

In this paper, effective Lorm Glove device is proposed which enables the communication between one-to-many in parallel, which can be especially helpful in special schools and other learning contexts. As a result, it empowers deaf-blind people to engage with a broader spectrum of people, thus enhancing their independence. This device is very safe, there is no contact made directly to the person who uses the glove. The device is operated in low voltage and is very unlikely to hurt someone. The next step will be a study with the aim to verify the functionality and effectiveness of the system in real life situations.The future scope of this work would be extending this work to provide an interface to access a broader range of information e.g. from websites, e-books or audio books. The capacitive touch sensor used in this work is relatively expensive.In future, advanced technologies could be created at reduced costs. Mobile Lorm Glove could be done by using printed circuit board (PCB) to reduce its complexity.

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